



**DEPARTMENT OF THE NAVY**

NAVAL SEA SYSTEMS COMMAND  
2531 JEFFERSON DAVIS HWY  
ARLINGTON VA 22242-5160

4751  
Ser 00C/5030  
22 July 1998

From: Commander, Naval Sea Systems Command

Subj: ADVANCE CHANGE NOTICE (ACN) TO NAVAL SHIPS' TECHNICAL  
MANUAL, NAVSEA S9086-CQ-STM-010/CH-081 R3, WATERBORNE  
UNDERWATER HULL CLEANING OF NAVY SHIPS

Ref: (a) Naval Ships' Technical Manual, NAVSEA S9086-CQ-STM-  
010/CH-081 R3, Waterborne Underwater Hull Cleaning of  
Navy Ships

Encl: (1) Changes to NAVSEA S9086-CQ-STM-010/CH-081 R3, cover  
page, paragraphs 081-1.2 through 081-1.2.7, 081-3.5.8,  
Table 081-1-1, Figure 081-1-1, and Table 081-3-3.

1. Enclosure (1) is forwarded as ACN 1/A (control number N00024-98-TM01) to reference (a) and is in effect on this date. Incorporate enclosure (1) as pen and ink changes to reference (a). Update the record of change page to reflect this change.
2. The change reflects efforts to streamline the waterborne inspection and cleaning process on submarine special hull treatment, revises the biofouling rating and reporting process, provides a new data sheet to record preclean biofouling inspection data, issues additional guidance on masker air system cleaning and approves distribution of the manual for public release.
3. Comments, recommended changes and suggestions are welcome. The Life Cycle Manager and technical point of contact for the underwater hull cleaning program is Mr. T. P. McCue, NAVSEA 00C55, at (703) 607-2761 commercial or 327-2761 DSN.

R. S. McCORD  
Director of Ocean Engineering  
Supervisor of Salvage and Diving

Enclosure (1)

This section of ACN 1/A (control number N00024-98-TM01) of NTSM Chapter 081, modifies the waterborne inspection and cleaning processes on submarines coated with special hull treatment and the biofouling rating process. All users of this chapter shall update the record of change page, identify the ACN number on each page modified, and make necessary pen and ink changes as follows:

Delete:  
Distribution Statement B.

Delete:  
Destruction Notice

Insert (new cover page attached):  
Distribution Statement A: This document has been approved for public release and sale; its distribution is unlimited.

Delete paragraph 081-3.5.8.

Insert paragraph:  
081-3.5.8 SUBMARINE SPECIAL HULL TREATMENT (SHT) CLEANING.  
Submarine hulls treated with SHT should be regularly scheduled for interim cleaning and pre-cleaning inspections. Pre-cleaning inspections should be conducted over the entire hull to assess and document the paint system's performance. When the fouling meets the cleaning criteria, hull cleaning on SHT is restricted to multi-brush cleaning units fitted with E-4 and/or E-3 brushes and hand-held hydraulic cleaning units utilizing brushes A-1, A-2, or D. In the event that tenacious filaments (e.g., grass) are present, brush E-2 may be used on multi-brush equipment only after the less aggressive brushes have proven ineffective in removal of this fouling. However, when the E-3 brushes are utilized they shall be new at the start of the operation. If at any time scratching or gouging of the SHT surface is noted, cleaning shall be suspended and new brushes installed prior to resuming work. If damage persists, the cleaning operation shall be canceled and NAVSEA 00C notified.

Delete Paragraph:  
081-2.2.1.a. NAVSEA 4730/3 (NSN 0116-LF-047-3020) Diver Hull Inspection Data

Insert paragraph:  
081-2.2.1.a. NAVSEA 4730/3 (NSN 0116-LF-115-1600) Diver Hull Inspection Data

Insert paragraph:  
081-2.2.1.g. NAVSEA 4730/3A (NSN 0116-LF-115-1500) Preclean Biofouling Inspection Data

Delete Paragraphs 081-1.2 through 081-1.2.7

Insert the following Paragraphs:

#### 081-1.2 PROGRESSIVE FOULING PATTERNS

081-1.2.1 GENERAL, The biological fouling of Navy ships is a recurring process following identifiable patterns of growth. Relatively few types of organisms are responsible for hull fouling and they tend to develop in the order listed in paragraphs 081-1.2.2.1 through 081-1.2.2.3 (depending on geographical locality).

081-1.2.2 TYPES AND CATEGORIES OF FOULING. The types of fouling are separated into soft, hard and composite categories. Soft fouling typically algae, slime and grasses, have a minimum effect on the coating systems and the performance of the ship. Hard fouling is more tenacious having a calcareous structure which may become detrimental to the performance of the ship and coating systems. Composite fouling is extremely detrimental to the ship's performance and coating and machinery systems.

081-1.2.2.1 SOFT FOULING. The dominant organisms in this stage of fouling are slime and grass.

081-1.2.2.1.1 SLIME. Formation of slime is the first step in the fouling process. Almost any object immersed in seawater rapidly accumulates a coating of slime, consisting of bacteria, fungi, protozoa, and algae. Bacteria frequently are attached within one-half hour of wetting the surface, and slime can often be felt by hand within an hour. The coating of slime is smooth and generally follows hull contours.

081-1.2.2.1.2 GRASS AND OTHER SOFT FOULING. Grass is a form of multicellular green and brown algae. It forms most heavily near the water-line, where adequate light is available for photosynthesis. It is less evident as depth increases, and the dominant color changes from green to brown.

081-1.2.2.2 HARD FOULING. The dominant organisms in this stage of fouling are barnacles (usually acorn) and tubeworms (serpulids). A colony of biofouling of various forms of hard growth along with the presence of soft shell-less growth, can occur in severe conditions.

081-1.2.2.2.1 BARNICLES. Acorn barnacles have conical hard shells with jagged tops.

081-1.2.2.2.2 TUBEWORMS. Tubeworms form intertwined tubes lying along or projecting out from the hull.

081-1.2.2.3 COMPOSITE FOULING. In advance stages of fouling, mature barnacles and tubeworms may be present along with calcareous bivalves organisms such as mussels or oysters, or hydroids with calcareous cellular structure such as coral or anemones. In advanced stages of fouling, the ship will be affected by slime, grass, barnacles, and tubeworms. In addition, this stage of fouling will include soft shell-less animal forms, such as hydroids, anemones, and tunicates (sea squirts).

081-1.2.3 FOULING RATING (FR). The fouling rating scale (Table 081-1-1) describes the 10 most frequently encountered fouling patterns in order of increasing severity. Representative photographs of each fouling pattern are provided in Figure 081-1-1.

081-1.2.4 FOULING RATING (FR) SCALE. A rating number has been assigned to each of the 10 fouling patterns on a scale of 0 to 100 in 10-point increments, The lowest number represents a clean hull and the higher numbers represent fouling organism populations of increasing variety and severity.

081-1.2.5 FOULING PERCENTAGES. The fouling percentage quantifies the density of fouling which covers a particular component or area of the hull (i.e., rudder, strut, propeller, stern, port side bow, starboard mid ship, sea chest, etc.).

Delete:

Table 081-1-1. FOULING RATINGS (FR) IN ORDER OF INCREASING SEVERITY

Insert the attached page for Table 081-1-1.

Delete:

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity

Insert the ten attached pages for Figure 081-1-1.

Following paragraph 081-3.5.5.5 insert the attached page for Table 081-3-3. MASKER AIR SYSTEM HULL ISOLATION VALVES

Insert following Paragraph 081-3.5.4:

NOTE

Table 081-3-3 is provided for guidance in identifying the masker air system hull isolation valves on various ship classes.

Insert following Paragraph 081-3.5.5:

NOTE

Table 081-3-3 is provided for guidance in identifying the masker air system hull isolation valves on various ship classes.

**S9086-CQ-STM-010/CH-081 R3**

Table 081-1-1. FOULING RATINGS (FR) IN ORDER OF INCREASING SEVERITY

Type	Fouling Rating (FR)	Description
Soft	0	A clean, foul-free surface; red and/or black AF paint or a bare metal surface.
Soft	10	Light shades of red and green (incipient slime). Bare metal and painted surfaces are visible beneath the fouling.
Soft	20	Slime as dark green patches with yellow or brown colored areas (advanced slime). Bare metal and painted surfaces may be obscured by the fouling.
Soft	30	Grass as filaments up to 3 inches (76 mm) in length, projections up to 1/4 inch (6.4 mm) in height; or a flat network of filaments, green, yellow, or brown in color; or soft non calcareous fouling such as sea cucumbers, sea grapes, or sea squirts projecting up to 1/4 inch (6.4 mm) in height. The fouling can not be easily wiped off by hand.
Hard	40	Calcareous fouling in the form of tubeworms less than ¼ inch in diameter or height.
Hard	50	Calcareous fouling in the form of barnacles less than ¼ inch in diameter or height.
Hard	60	Combination of tubeworms and barnacles, less than ¼ inch (6.4 mm) in diameter or height.
Hard	70	Combination of tubeworms and barnacles, greater than ¼ inch in diameter or height.
Hard	80	Tubeworms closely packed together and growing upright away from surface. Barnacles growing one on top of another, ¼ inch or less in height. Calcareous shells appear clean or white in color.
Hard	90	Dense growth of tubeworms with barnacles, ¼ inch or greater in height; Calcareous shells brown in color (oysters and mussels); or with slime or grass overlay.
Composite	100	All forms of fouling present, Soft and Hard, particularly soft sedentary animals without calcareous covering (tunicates) growing over various forms of hard growth.

THIRD REVISION

**NAVAL SHIPS' TECHNICAL MANUAL**

**CHAPTER 081**

**WATERBORNE UNDERWATER HULL  
CLEANING OF NAVY SHIPS**



THIS CHAPTER SUPERSEDES CHAPTER 081 DATED 1 OCTOBER 1989

DISTRIBUTION STATEMENT A: THIS DOCUMENT HAS BEEN APPROVED FOR  
PUBLIC RELEASE AND SALE; ITS DISTRIBUTION IS UNLIMITED.

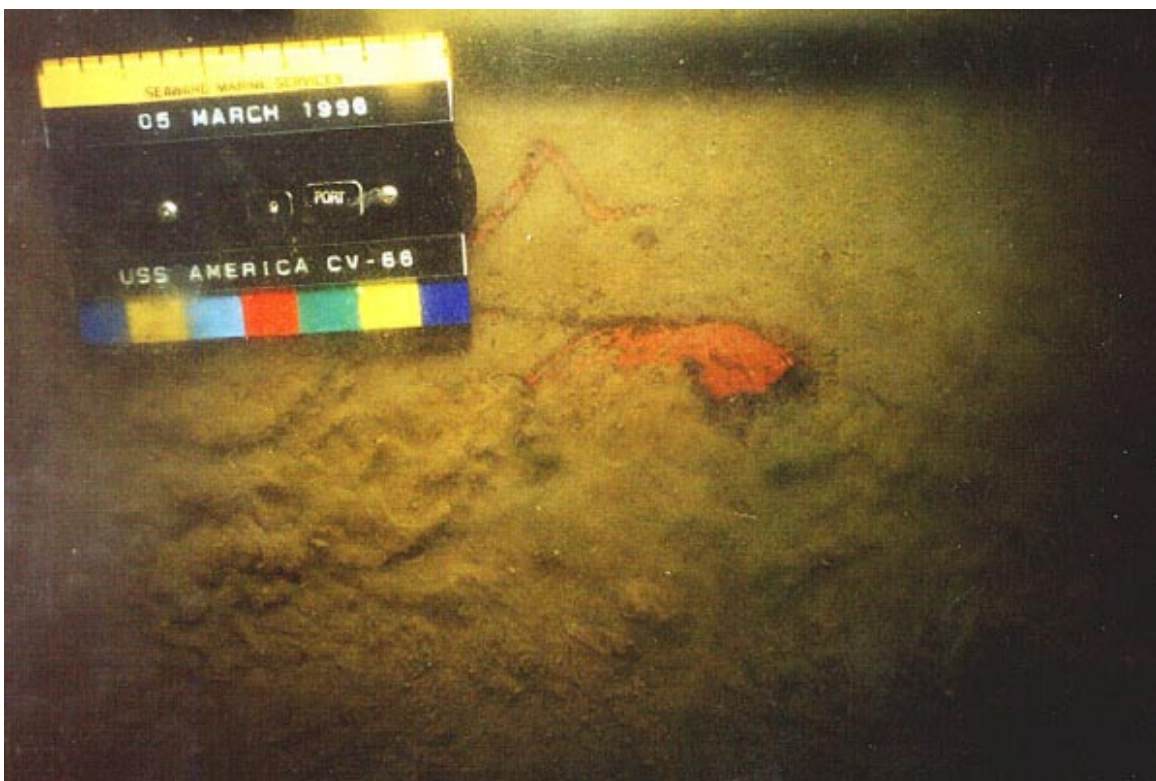
PUBLISHED BY DIRECTION OF COMMANDER, NAVAL SEA SYSTEMS COMMAND.

---

**4 AUGUST 1997**



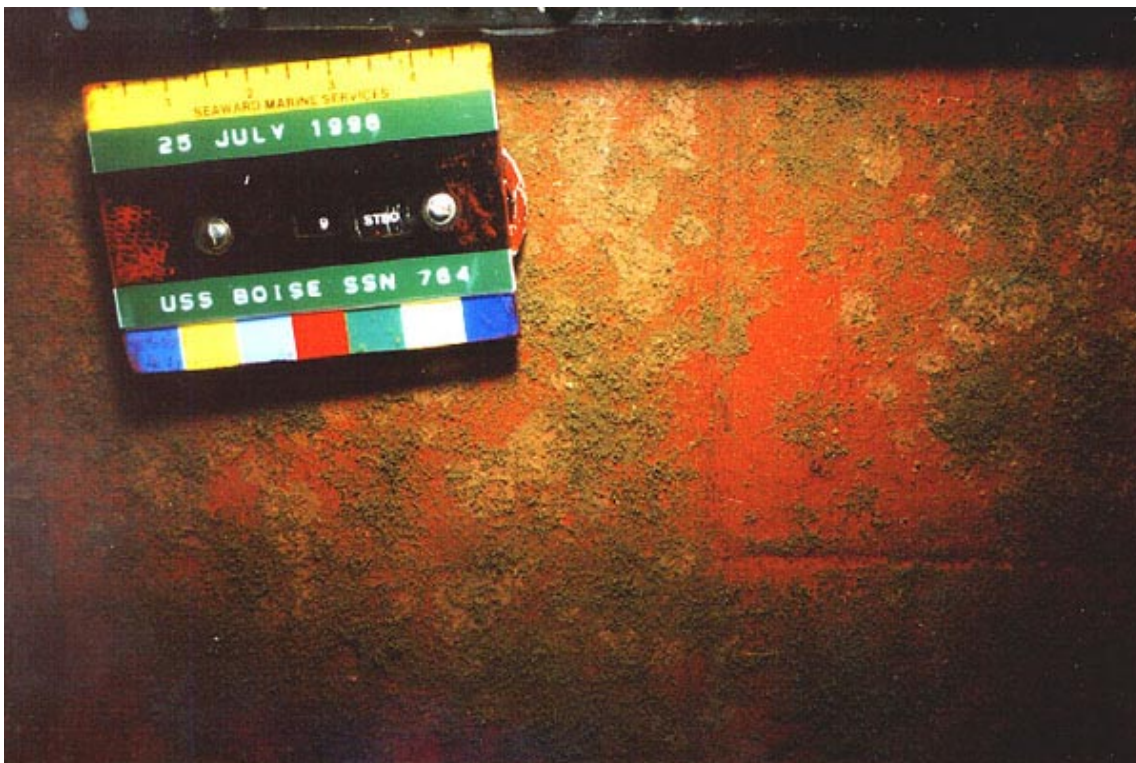
FR-10, over 30 percent of area



FR-10, over 100 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 1 of 11).





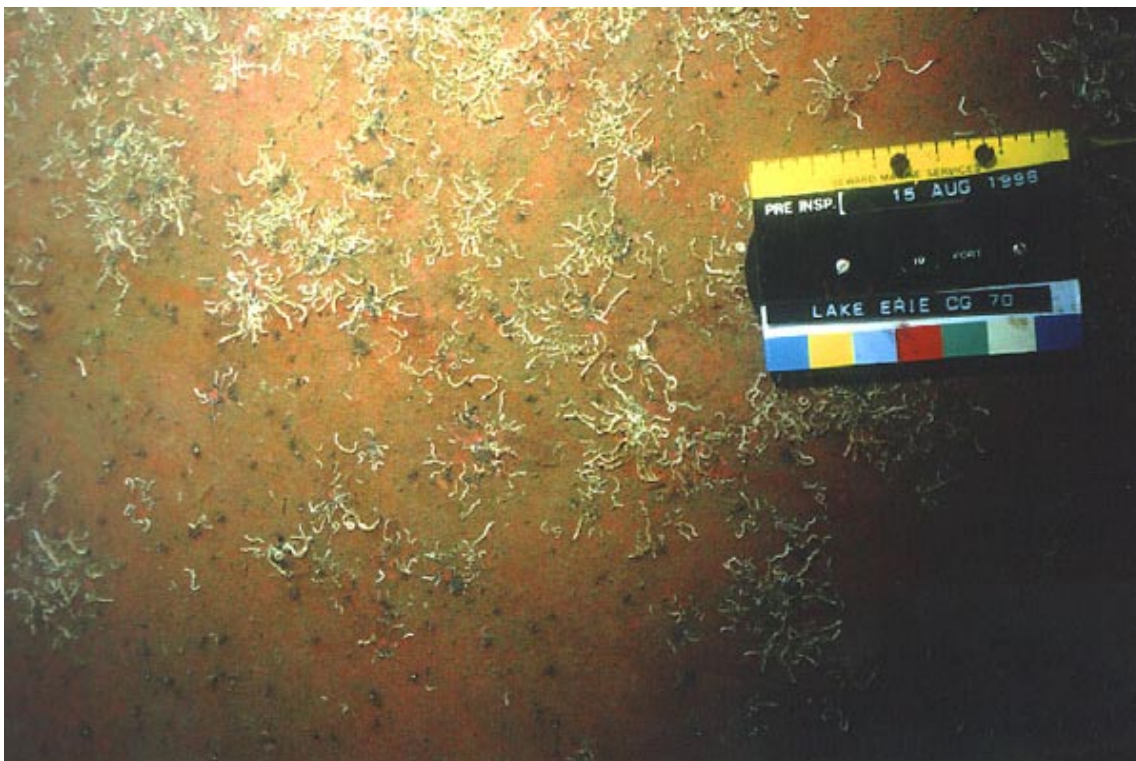
FR-20, over 80 percent of area



FR-30, over 40 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 2 of 11).





FR-40, over 20 percent of area



FR-40, over 30 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 3 of 11).





FR-40, over 90 percent of area



FR-50, over 20 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 4 of 11).





FR-50, over 40 percent of area



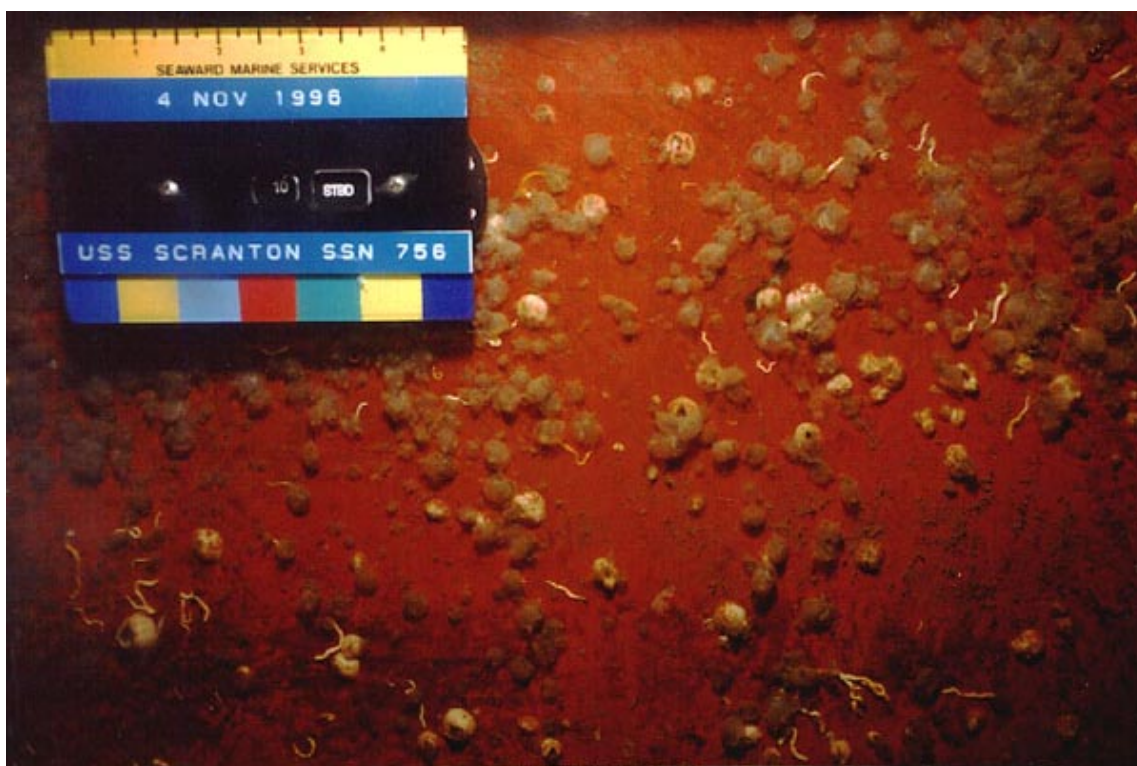
FR-50, over 100 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 5 of 11).





FR-60, over 15 percent of area



FR-60, over 20 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 6 of 11).





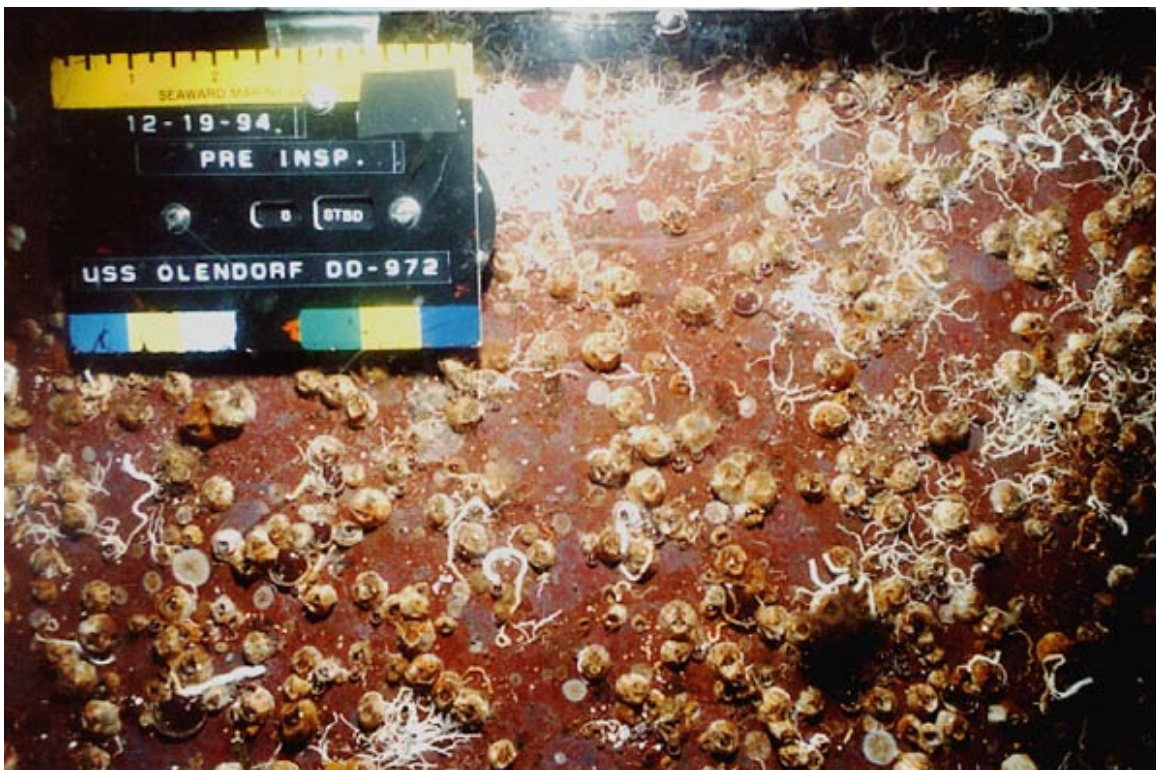
FR-60, over 90 percent of area



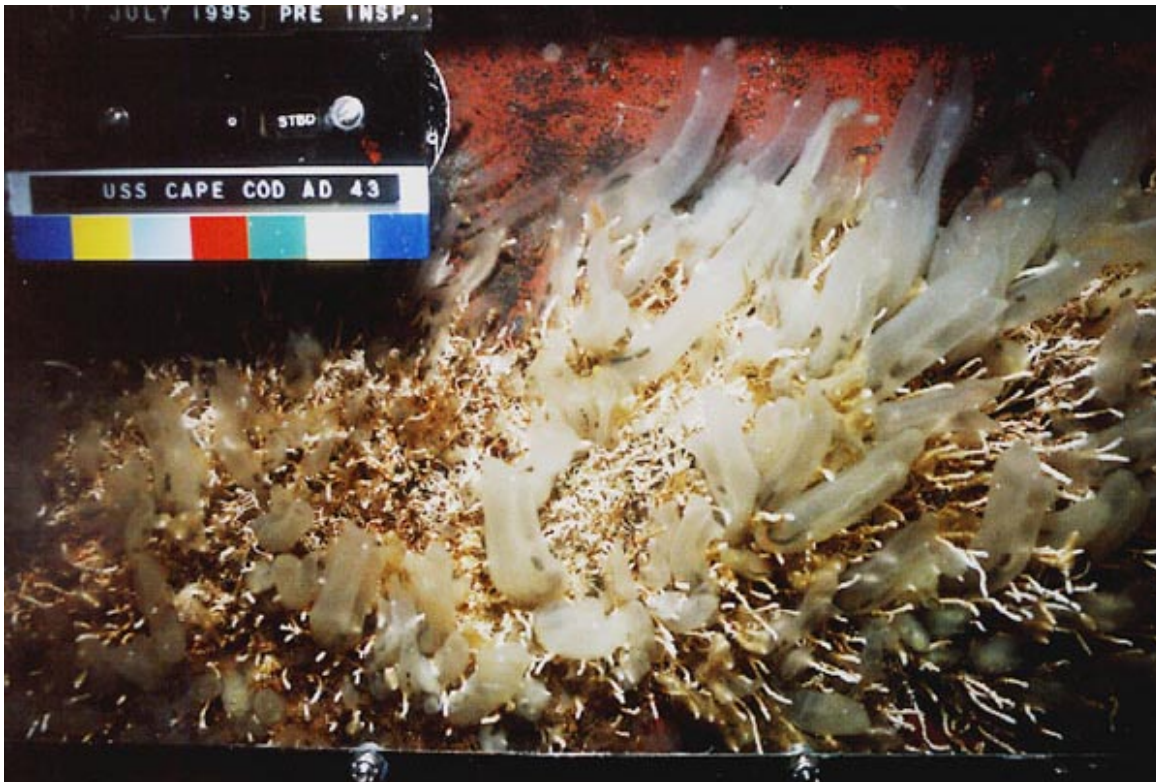
FR-70, over 20 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 7 of 11).





FR-70, over 80 percent of area



FR-80, over 60 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 8 of 11).





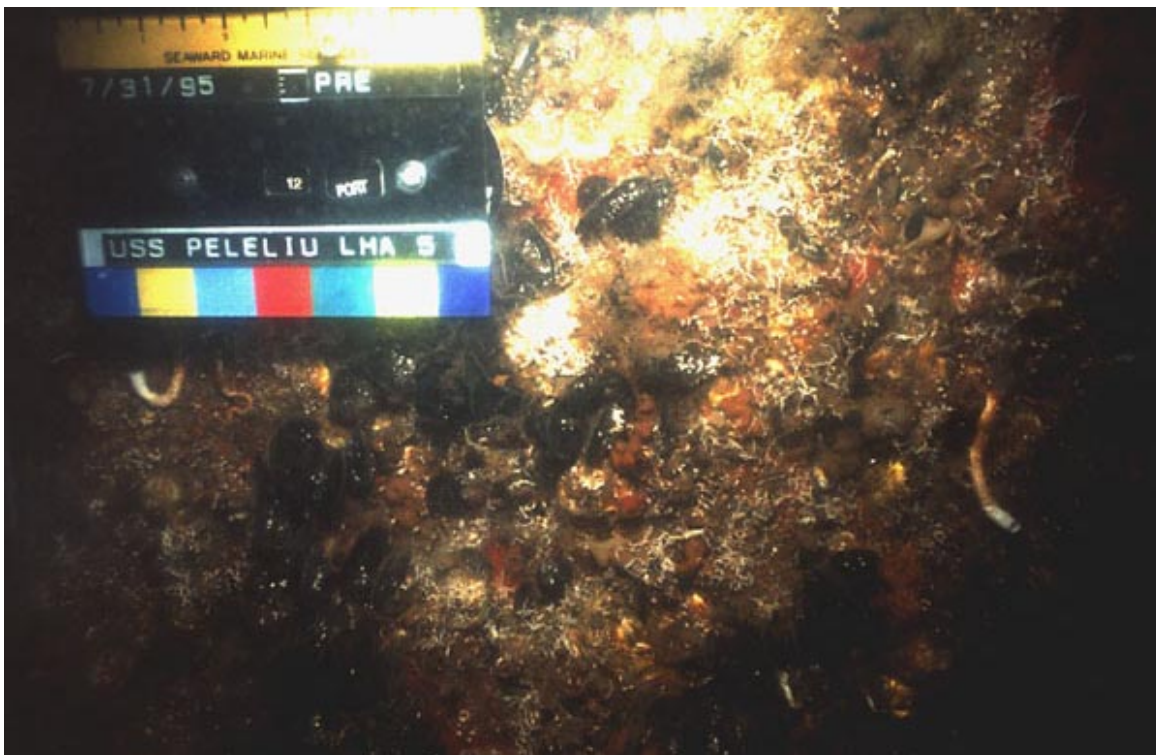
FR-80, over 80 percent of area



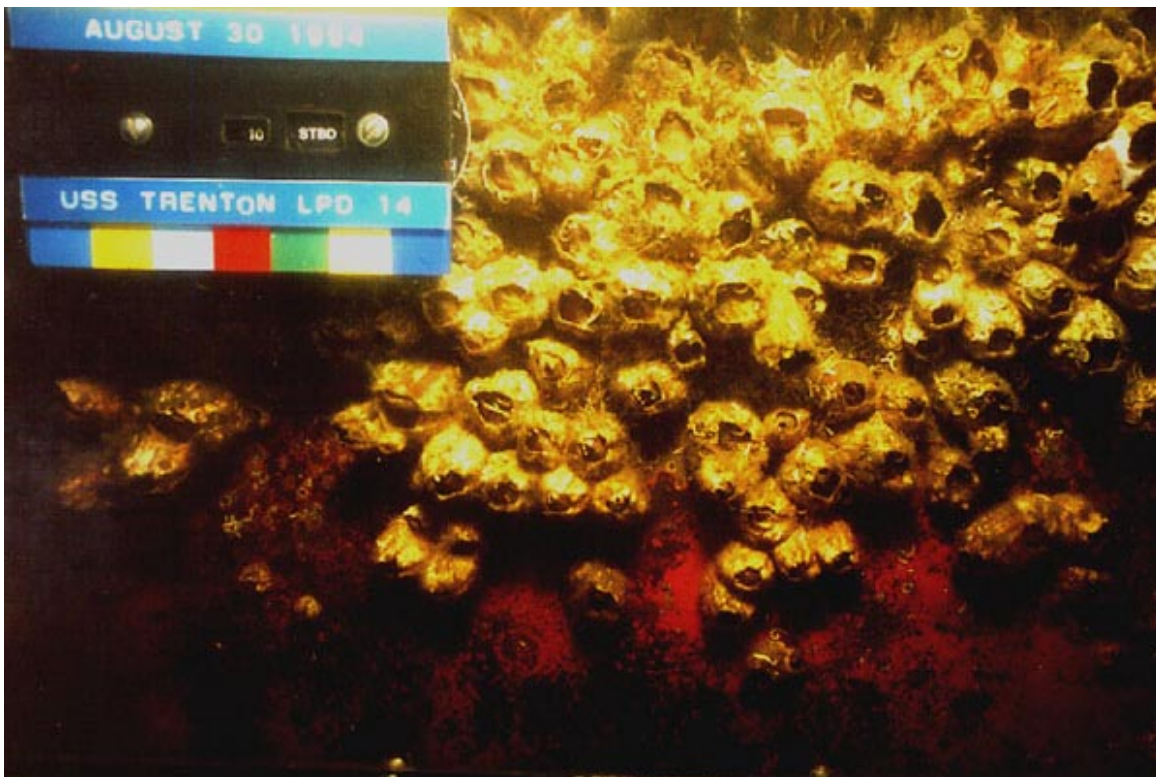
FR-80, over 90 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 9 of 11).





FR-90, over 90 percent of area



FR-90, over 90 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 10 of 11).





FR-100, over 50 percent of area



FR-100, over 100 percent of area

Figure 081-1-1. Typical Fouling Ratings (FR) in Order of Increasing Severity (sheet 11 of 11).

## S9086-CQ-STM-010/CH-081 R3

**Table 081-3-3. MASKER AIR SYSTEM HULL ISOLATION VALVES**

	SHIP CLASS			
	FFG-7	DD-963 DDG-993	CG-47	DDG-51
Hub Air Cut Off Valves	N/A	MA-627	MA-627	MA-V-97
Emitter Belt Hull Stop Valves	2-175-2	MA-23	MA-23	MA-V-(2-122-2)
	2-177-1	MA-31	MA-39	MA-V-(2-122-1)
	PMA-V5A	MA-39	MA-47	MA-V-(2-172-1)
	PMA-V5B	MA-47	MA-63	MA-V-(2-172-2)
		MA-55	MA-102	MA-V-(1-232-1)
		MA-63	MA-110	MA-V-(1-232-2)
		MA-102	MA-126	
		MA-110	MA-134	
		MA-118		
		MA-126		
		MA-134		
		MA-142		

NOTE: The valves presented in Table 081-3-3 are provided as guidance only. System configurations should be verified on each ship to ensure the proper valves are identified and secured.